

(12) UK Patent Application (19) GB (11) 2 343 879 (13) A

(43) Date of A Publication 24.05.2000

(21) Application No 9825132.5

(22) Date of Filing 17.11.1998

(71) Applicant(s)

Quantum Leap Technologies Ltd
(Incorporated in the United Kingdom)
PO Box 33, Nelson Mill, Gaskell Street, BOLTON,
Lancashire, BL1 2QS, United Kingdom

(72) Inventor(s)

Gary Sewell

(74) Agent and/or Address for Service

Quantum Leap Technologies Ltd
PO Box 33, Nelson Mill, Gaskell Street, BOLTON,
Lancashire, BL1 2QS, United Kingdom

(51) INT CL⁷

B66C 1/02

(52) UK CL (Edition R)

B8H HPB

(56) Documents Cited

GB 2295799 A GB 2259079 A EP 0275491 A1
SU 001766910 A

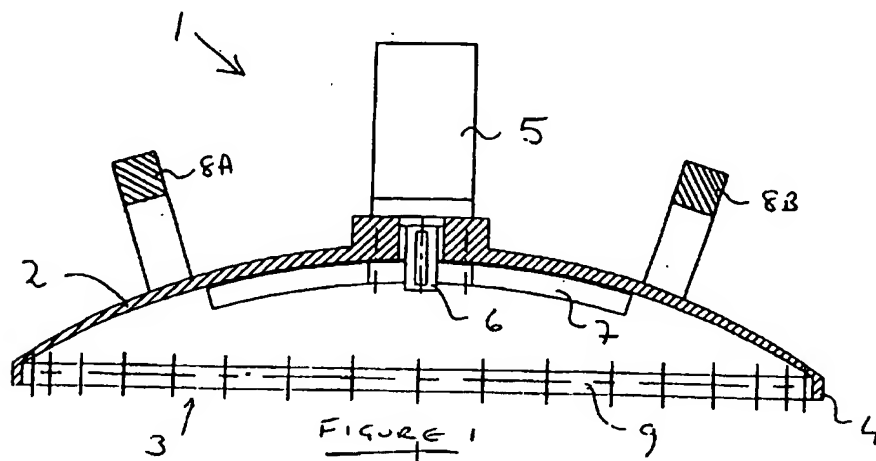
(58) Field of Search

UK CL (Edition Q) B8H HKF HPB
INT CL⁶ B66C 1/02
ONLINE : WPI, EPODOC, JAPIO

(54) Abstract Title

Suction Gripper

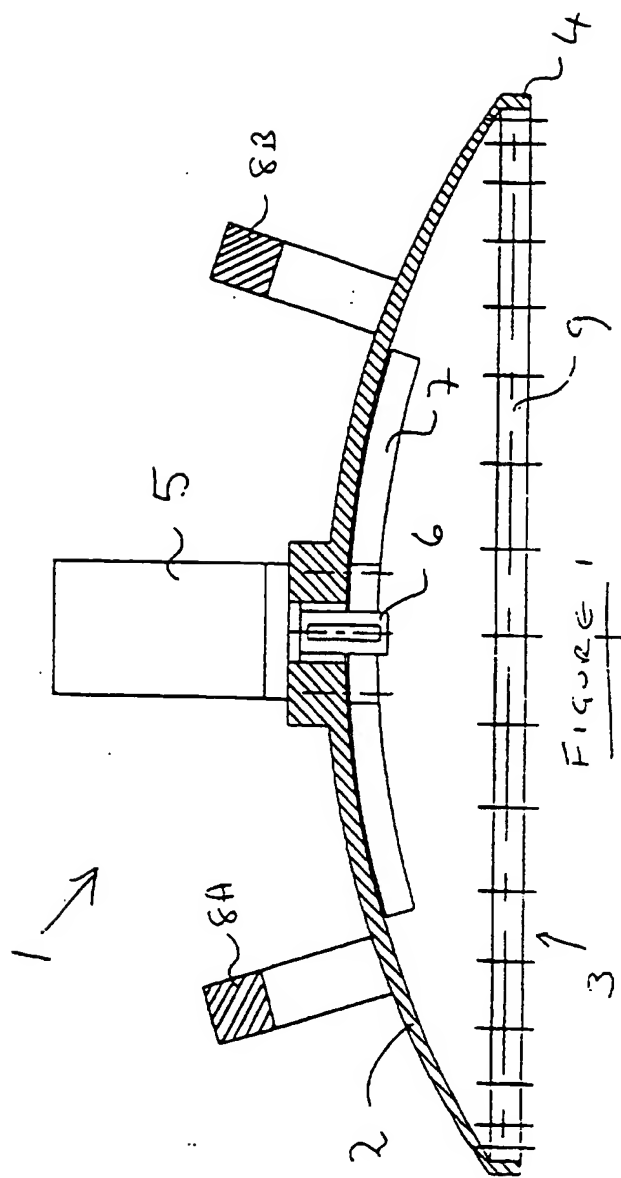
(57) A suction gripper has a curved shell 2 in which impeller blades 7 rotate to enable a vacuum to be developed to allow object to be picked up. Preferably a motor 5 such as an electric one is provided on the outside of the shell and handles 8A, B. Preferably the shell has a lip 4 and a grill 9 to protect the blades from foreign objects. The gripper may be provided on the end of a robot arm.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date but within the period prescribed by Rule 25(1) of the Patents Rules 1995.

GB 2 343 879 A



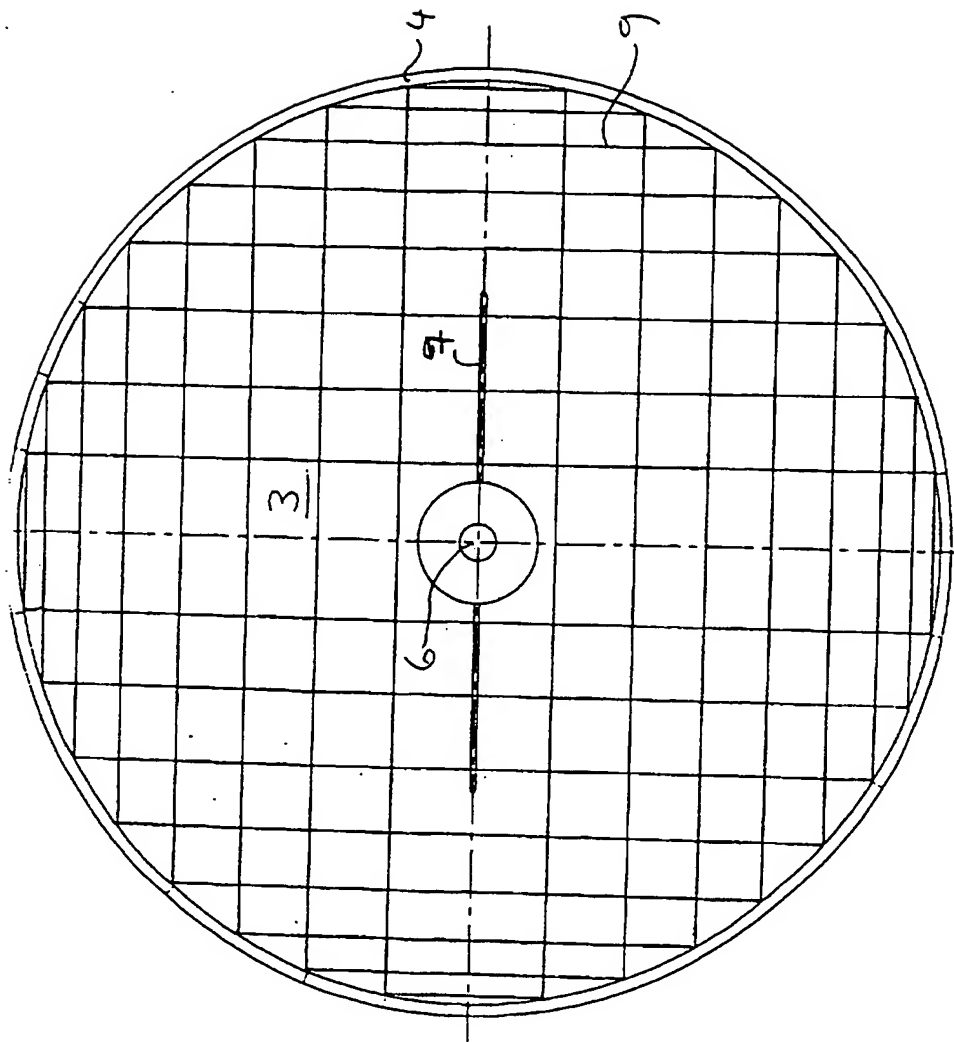


FIGURE 2

Title: Attachment Device

The present invention relates to an attachment device adapted to releasably secure itself to the surface of an object.

It is often desirable to lift or move objects with a device without the device being physically secured to the object. For example robotic or other machinery arms often support a lifting head operated by a vacuum pump to lift objects such as paper or other sheet material or indeed other objects. A difficulty with this arrangement is that an array of pipework is necessary to connect the head to the vacuum pump.

The invention seeks to provide a novel device which may have numerous applications.

According to the present invention there is provided an attachment device adapted to releasably secure itself to the surface of an object comprising:

- a) a container having a substantially circular open face,
- b) at least one blade for rotation in the container, and
- c) a drive means to drive the blade,

whereby when open face is placed against the surface of an object and the blade rotated the air pressure inside the container is reduced compared to ambient pressure so that the attachment device is secured to the surface of an object.

Preferably the blade(s) creates a low pressure forced vortex (tornado) below the container to draw the device and the object together.

The drive means may be an engine or motor and may be mounted outside the container on the side of the container remote from the open face. Preferably the blade(s) is mounted on a shaft extending through container wall, preferably at about the centre of the container wall.

Preferably the container is a concave dish. Preferably the dish has a lip around the edge of the dish defining said open face. Preferably the blade(s) is curved to lie generally parallel to the curvature of the concave dish.

One or more handles may be provided on the container to lift the container.

A grill may be provided across the open face of the container to prevent ingestion of foreign objects to protect the blade(s) when it rotates.

An embodiment of the invention will now be described with reference to the accompanying drawings in which:

Figure 1 shows a cross section view of a device, and

Figure 2 shows a plan view of the open face of the device of Figure 1.

Referring to Figure 1 there is shown an attachment device 1 having a container formed from a concave dish 2 having a circular open face 3 (see Figure 2). A lip 4 is provided around the edge of the dish to define the open face.

A drive means in the form of an electric motor 5 is mounted outside the dish on the side of the dish remote from the open face. Motor 5 includes a drive shaft 6 which extends through the centre of the wall of the dish. A blade 7 is mounted at its centre on the shaft 6. Motor 5 thus drives the blade. Blade 7 is curved with a radius of curvature such that it lies generally parallel to the curvature of the concave dish.

A pair of handles 8A,8B are mounted on the dish to lift the device. A grill 9 may be provided across the open face of the container to prevent ingestion of foreign objects to protect the blade 7 when it rotates.

Motor 5 may be powered by any suitable supply of electricity such as a battery or a connection to a mains supply.

When the device 1 is held is some distance away from an object and the blade 7 is not being driven by the motor 5, the air particles move in a random fashion, isotropically distributed.

When however the device the blade 7 is driven by the motor 5, air particles are radially displaced from the centre of the blade towards the blade tips. This results in the creation of a radial density gradient, with the air particle density reducing from the ambient density a few centimetres away from the blade tips to a lower density region below the centre of the blade. This results in the formation of a low pressure rotational column of air in the form of a forced vortex below the device. This low pressure column draws the device and the surface of the object together as the pressure above the device and below the surface of the object will be at a higher ambient pressure.

When the device 1 actually makes contact with the surface of the object (with the lip 4 abutting the surface of the object) the volume of air trapped in the cavity formed by the dish and the surface of the object is circulated rotationally by the blade to produce an anisotropically, toroidal shaped flow of air in the cavity (the air flows from the centre of the blade to the tips, and is then diverted downwards and around the lip 4 and then along the surface of the object back to the centre of the blade). The anisotropic (rotationally directed) nature of the air flow in the cavity ensures that the air pressure in the cavity is lower than the ambient pressure outside the cavity. This ensures the device 1 and the surface of the object are secured together. The object may be lifted or moved by using the handles on the device.

The device of the invention may take a different form to that specifically described. For example more than one blade could be provided, and the housing could take a different shape to the dish shown. The motor could be other than an electric motor, e.g. an internal combustion engine.

The device of the invention may have numerous applications. The device shown in the drawing may be used as a hand-held lifting device, e.g. for lifting sheets of glass. The device may however be designed to be used on the end of robotic arms to lift or move workpieces.

Further modifications will be apparent to those skilled in the art without departing from the scope of the present invention.

CLAIMS

1. An attachment device adapted to releasably secure itself to the surface of an object, comprising a container having a substantially circular open face, at least one blade for rotation in the container and a drive means to drive the blade, whereby when the blade is rotated a lower than ambient air pressure rotational column of air, forced vortex, is formed from the rotating blade to the surface of another object, causing the attachment device and object to be pushed together by the relatively higher ambient air pressure acting on the top surface of the attachment device and on the underside of the object being lifted.
2. An attachment device as claimed in Claim 1 where the mode of operation when the blade(s) is being driven by the motor and when the attachment device is not in physical contact with another object can be explained by the radial displacement of air (radial momentum exchange) from the centre of the blade(s) towards the blade(s) tips, as the blade(s) rotates in the air results in the forced vortex mentioned in Claim 1.
3. An attachment device as claimed in Claim 1 where the mode of operation when the blade(s) is being driven by the motor and when the attachment device is in direct physical contact with another object, i.e. with the lip around the open face of the device abutting the surface of the object, the volume of air trapped in the cavity formed by the dish and the surface is circulated rotationally by the blade(s) to produce an anisotropically (rotationally directed) flow of air whose pressure is lower than the ambient air pressure outside the cavity.
4. An attachment device as claimed in Claim 2 or Claim 3 whose drive means may be an engine or motor and may be mounted outside the container on the side of the container remote from the open face.
5. An attachment device as claimed in Claim 4 where the blade(s) is mounted on a shaft (connected to the motor) and extending through the container wall, preferably at about the centre of the container wall.
6. An attachment device as claimed in any preceding claim where the container is preferably a concave dish which has a lip around the edge defining said open face.

7. An attachment device as claimed in any preceding claim whose blade(s) are preferably curved and lie generally parallel to the curvature of the concave dish.
8. An attachment device as claimed in any preceding claim which has one or more handles on the container dish to enable the container dish to be lifted.
9. An attachment device as claimed in any preceding claim which has a grill provided across the open face of the container dish to prevent ingestion of foreign objects to protect the blade(s) when it rotates.
10. An attachment device as claimed in any preceding claim where the air particles move in a random, isotropically distributed fashion when the blade(s) is not being driven by the motor.
11. An attachment device as claimed in any preceding claim which has more than one blade.
12. An attachment device as claimed in any preceding claim which has a container whose shape can be different from the concave dish shown in the accompanying drawings.
13. An attachment device as claimed in any preceding claim which uses a motor other than an electric motor, eg an internal combustion engine.
14. An attachment device as claimed in any preceding claim which can be used for numerous applications, including a hand-held lifting device or as a lifting device attached to the end of a robotic arm.
15. An attachment device substantially as herein described and illustrated in the accompanying drawings.



Application No: GB 9825132.5
Claims searched: 1-15

Examiner: Dave McMunn
Date of search: 26 July 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): B8H (HKF, HPB).

Int Cl (Ed.6): B66C 1/02.

Other: ONLINE : WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2,295,799 A (SMITH). See Figs 1-3	1-14
X	GB 2,259,079 A (CONWAY). See Figs	1-14
X	EP 0,275,491 A1 (SMH ALCATEL). See Figs	1-14
X	SU 1,766,910 (SILICATE). See Fig & WPI abstract	1-14

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.